SOPHIA COLLEGE (AUTONOMOUS)

Affiliated to

UNIVERSITY OF MUMBAI

Programme: Microbiology

Programme code: SMCB

F.Y.B.Sc. Microbiology

(Choice Based Credit System with effect from the year 2023-2024)

Based on the National Education Policy 2020

Course code	Unit No.	Name of Unit	Credits
DSC: SMCB111MJ		FUNDAMENTALS OF MICROBIOLOGY	3 Credits
	1	History of Microbiology and Prokaryotic Cell Structure And Function	
	2	Eukaryotic Cell Structure And Function	
	3	Microscopy & Staining procedures	
SMCB111MJP		FUNDAMENTALS OF MICROBIOLOGY (Practicals Based On Unit-I, II & III)	1 Credit
VSC1 : SVSC107		CULTIVATION OF MICROORGANISMS	1 Credit
		CULTIVATION OF MICROORGANISM PRACTICALS	1 Credit
VSC2 : SVSC108		CONTROL OF MICROORGANISMS	1 Credit
		CONTROL OF MICROORGANISMS PRACTICALS	1 Credit

Programme Outline: FYBSc Microbiology Major (SEMESTER II)

Course code	Unit No.	Name of Unit	Credits
DSC: SMCB122MJ		MICROBIAL DIVERSITY, INTERACTIONS AND GROWTH	3 Credits
	1	Study Of Viruses, Rickettsia, Chlamydia, Actinomycetes and Archaea	
	2	Study of Microbial Interactions	
	3	Microbial growth	
SMCB122MJP		MICROBIAL DIVERSITY, INTERACTIONS AND GROWTH (Practicals Based On Unit-I, II & III)	1 Credit
SEC 1: SSEC207		MICROBES & HUMAN HEALTH	1 Credit
SSEC207P		MICROBES & HUMAN HEALTH PRACTICALS	1 Credit
SEC2: SSEC208		MICROBIAL TECHNOLOGY	1 Credit
SSEC208P		MICROBIAL TECHNOLOGY PRACTICALS	1 Credit

Preamble:

The department of Microbiology at Sophia College was founded in 1966. Microbiology is the study of life and tentative life forms that cannot be viewed by the unaided eye. The microscopic life encompasses bacteria, protozoa, algae, fungi, and viruses. These organisms impact many aspects of plant, animal and human life and progress.

The Undergraduate curriculum provides fundamental and applied aspects of Microbial life that impacts the rest of the biosphere.

The instructions methodology focuses on providing the fundamental basic information on Microbiology and progressing to the advances. Furthermore, there is emphasis on developing critical and analytical thinking and reasoning skills through problem solving in keeping with the changing times. The courses provide training in Genetics, Biochemistry, Medical Microbiology, Immunology, Bioprocess technology, Food Science and Environmental Science. This interdisciplinary approach helps learners meet the requirements of higher education, research and industry.

On completion of B.Sc. Microbiology, the learners should be able to:

PROGRAMME OBJECTIVES

PO 1	To introduce the learners to Basic and Applied Microbiology.
PO 2	To build a strong knowledge base in the learner as well as impart sound practical skills in the subject.
PO 3	To provide opportunities for logical thinking, and critical reasoning, such that the learners can handle the demands of higher education, industry and research.
PO4	To impart soft skills in learners thereby enhancing employability.

PROGRAMME SPECIFIC OUTCOMES

PSO 1	The learners will gain and apply knowledge of Genetics, Virology, Microbial Biochemistry, Medical Microbiology, Immunology, Cell Biology, Bioprocess technology, Environmental Microbiology, Food and Dairy Microbiology, etc to solve problems.
PSO 2	The learners will acquire basic knowledge about scientific methodology, plan and execute experiments using good laboratory practices, and interpret the experimental results effectively.
PSO 3	The students will undertake research projects, internships, visit industries, in order to become ready for higher studies, industry and research.
PSO 4	The students will do value added courses in order to enhance their soft skills and employability.

NAME OF THE COURSE	FUNDAMENTALS OF MICROBIOLOGY	
CLASS	FYBSC	
COURSE CODE	SMCB111MJ	
NUMBER OF CREDITS	3	
NUMBER OF LECTURES PER WEEK	3	
TOTAL NUMBER OF LECTURES PER SEMESTER	45	
EVALUATION METHOD TOTAL MARKS	CONTINUOUS ASSESSMENT 50	SUMMATIVE ASSESSMENT 50
PASSING MARKS	40 out of 100	

COURSE OBJECTIVES:

CO 1.	To provide a glimpse of the microbial world and pioneers in the field of microbiology.
CO 2.	To promote the understanding of fundamental aspects of microbial cell structure and function as well as the differences between Prokaryotic and Eukaryotic Cells
CO 3.	To review the structural details of eukaryotic cells.
CO 4.	To explore the life cycles and also highlight the morphological characteristics , significance of yeast, molds, protozoa.
CO 5.	To revise the concept of magnification, resolving power and numerical aperture
CO 6.	To provide realization of the crucial role of a light microscope in the study of microorganisms and use oil immersion objective for observing microorganisms
CO 7.	To understand the principle of various staining procedures for studying bacterial cell structure.

COURSE LEARNING OUTCOMES:

CLO 1.	The learner will be able to review the basic characteristics of prokaryotic and eukaryotic cells.
CLO 2.	The learner will be able to describe the cellular makeup of bacteria.
CLO 3.	The learner will be able to enlist the major events in the history of microbiology, including the major contributors to the early development of microscopy, the germ theory of disease, aseptic techniques and medical advances.
CLO 4.	The learner will be able to outline a new system of classification of organisms in domains and cite representatives of each domain.

CLO 5.	The learner will be able to describe the morphological characteristics, life Cycle and significance of *Saccharomyces cerevisiae* , *Rhizopus,Chlamydomonas,Slime mold, Entamoeba histolytica* .
CLO 6.	The learner will be able to explain how the magnified images are formed, and how properties of light/ resolution affects image visibility.
CLO 7.	The learner will be able to explain the principle and procedure for simple, differential, and special stainings
CLO 8.	The learner will be able to describe the process of Gram staining and acid fast staining and how the results can aid the identification of pathogens.

UNIT 1	History of Microbiology and Prokaryotic Cell Structure (15 lectures)
1.1	Milestones in Microbiology a. History Of Microbiology b. Discovery of microorganisms c. Conflict over spontaneous generation d. Golden Age of Microbiology-Koch Postulate e. Classification of organisms
1.2	Bacterial cell structure a. Morphology and Arrangement b. Cell wall c. Plasma membrane d. Chromosome and plasmid e. Ribosomes. f. Structures external to the cell wall:Capsule, Slime layer, Flagella, Pili, and Fimbriae. g. Endospores h. Organic and inorganic inclusion bodies
UNIT 2	Eukaryotic Cell Structure And Function (15 lectures)
2.1	Overview of eukaryotic cell structure: a. Plasma membrane b. Cytoplasmic matrix, Cytoskeletal elements c. Endoplasmic reticulum, d. Ribosomes e. Golgi apparatus f. Mitochondria g. Chloroplasts h. Nucleus i. Cilia and Flagella.

2.2	Morphological characteristics, Life Cycle and Significance of: a. Yeast and Molds (*Saccharomyces cerevisiae* and *Rhizopus*) b. Algae (*Chlamydomonas*) c. Slime Molds and Myxomycetes d. Protozoa (*Entamoeba histolytica*)
UNIT 3	Microscopy & Staining procedures (15 lectures)
3.1	Microscopy: a. History of microscopy b. Structure and functions of different parts of a microscope c. Simple and compound light microscope
3.2	Staining procedures a. Stains: Types of stains (Acidic, Basic, Compound) b. Fixatives, Mordants and Decolorizers. c. Simple and Differential staining (Gram and Acid Fast) d. Special staining (Cell wall, Capsule, Lipid granules, Spores, Metachromatic granules & Flagella)

REFERENCES:

SMCB111MJ

1. Madigan, M. T.; Bender K. , Buckley D. (2021). Brock Biology of Microorganisms. 16th Global edn-San Francisco: Pearson International edition.
2. Pelczar Jr, M. J.; Chan, E.C.S. & Krieg, N. R. (1986). Microbiology 5th edn. New York:Tata McGraw-Hill Education Pvt. Ltd
3. Tortora G.J., Funke, B.R., Case, C.L., 2020 Microbiology: an introduction. 13th Global edn. Pearson
4. Willey J. , Sandman K , Wood D. Prescott's Microbiology (ISE)(2019) 11th edn– McGraw-Hill Education.
5. Stanier, R. Y.; Ingraham, J. L.; Wheelis, M. L. & Painter, R. P. (1992). General Microbiology 5th edn. Cornell university: Macmillan, Hampshire & London.

NAME OF THE COURSE	FUNDAMENTALS OF MICROBIOLOGY PRACTICALS	
CLASS	FYBSc	
COURSE CODE	SMCB111MJP	
NUMBER OF CREDITS	1	
NUMBER OF LECTURES PER WEEK	2	
TOTAL NUMBER OF LECTURES PER SEMESTER	30	
EVALUATION METHOD	CONTINUOUS ASSESSMENT	SUMMATIVE ASSESSMENT
TOTAL MARKS	-	50
PASSING MARKS	-	20

COURSE OBJECTIVES:

CO 1.	To train the learners in understanding the principle and technique of using a compound light microscope to observe microorganisms and microscopic structures.
CO 2.	To impart skills in performing various simple, differential and special staining techniques in order to observe the morphology, arrangement and intracellular and extracellular structures of microorganisms.
CO 3.	To train learners, prepare wet mounts of various samples for microscopic observation.
CO 4.	To train learners in observational skills, recording results and presenting the findings in a concise manner using appropriate tools in the form of videos and PowerPoint presentations.
CO 5.	To train learners gain knowledge about the morphology, arrangement, and Gram nature of common microorganisms, including Gram variable microbes.

COURSE LEARNING OUTCOMES:

CLO 1	The learner will be able to operate a compound light microscope, adjust the light as well as use different objectives.
CLO 2	The learner will be able to use the compound light microscope to observe the morphology of microorganisms using simple and differential staining techniques and interpret the results
CLO 3	The learner will be able to demonstrate the presence of intracellular and extracellular structures that are characteristics of specific bacteria using special staining techniques.
CLO 4	The learner will be able to prepare wet mounts of pond water, hay infusion, etc., and

	observe the microorganisms present.
CLO 5	The learner will be able to document observations from the wet mount of various samples and microorganisms video recording and PowerPoint presentation as well as describe the microorganisms seen.
CLO 6	The learner will be able to tabulate 10 common microorganisms, including their names, morphology, arrangement, Gram nature, and diagrams, demonstrating their understanding of microbial diversity and characteristics.

Practical Sr. No.	**DSC Practicals-Fundamentals Of Microbiology**
1	Use and care of a microscope
2	Monochrome staining
3	Negative Staining.
4	Differential staining: Gram staining
5	Cell wall staining
6	Demonstration of capsule.
7	Endospore staining
8	Lipid staining
9	Metachromatic granules staining
10	Flagella staining (Demonstration)
11	Preparation of Wet mount of pond water / hay infusion / flavoured curd: Observations to be recorded as a Video.
12	Preparation of Wet mount of molds: Observations to be presented using a Powerpoint Point.
13	Assignment: Tabulation of names, morphology, arrangement and Gram nature with diagrams of 10 common microorganisms including Gram variable microorganisms.

NAME OF THE COURSE	VSC1: CULTIVATION OF MICROORGANISMS	
CLASS	FYBSc	
COURSE CODE	SVSC107	
NUMBER OF CREDITS	01 (Theory) + 1 (Practical)	
NUMBER OF LECTURES PER WEEK	01 (Theory) + 2 (Practical)	
TOTAL NUMBER OF LECTURES PER SEMESTER	15 (Theory) + 30 (Practical)	
EVALUATION METHOD	CONTINUOUS ASSESSMENT	SUMMATIVE ASSESSMENT
TOTAL MARKS	50	-
PASSING MARKS	20	-

COURSE OBJECTIVES:

CO 1	To list differences in nutritional modes of microorganisms
CO 2	To introduce the concept of pure culture
CO 3	To train students to use various techniques of inoculation for growing microorganisms from provided samples.
CO 4	To outline the processes and purposes of the procedures that are used in handling, maintaining, and studying microorganisms.
CO 5	To explain the importance of media for culturing microbes in the laboratory.

COURSE LEARNING OUTCOMES:

CLO 1	The learner will be able to prepare microbiological media using basic ingredients.
CLO 2	The learner will be able to identify the purpose of enriched, selective, and differential media
CLO 3	The learner will be able to select an appropriate growth medium or method for experimental work.
CLO 4	The learner will be able to apply the knowledge of inoculation methods for isolating a variety of bacteria
CLO 5	The learner will be able to study and identify isolates based on features of their colonies formed on solid media
CLO 6	The learner will be able to preserve different types of microbial cultures for the desired duration.

SVSC107	Cultivation of Microorganisms (15 Lectures)
	a. World of microorganisms b. Nutritional requirements – Macro and Micronutrients, growth factors. c. Nutritional types of microorganisms d. Culture media: Types with examples e. Methods of Inoculation f. Pure culture techniques g. Cultivation of anaerobes h. Preservation of microbial cultures i. List of Microbial Culture Collection Centres
Practical Sr. No.	Cultivation of Microorganisms Practicals (30 lectures)
1	Preparation of Culture Media: a. Liquid medium (Nutrient Broth) b. Solid Media (Nutrient agar & Sabouraud's agar)
2	Preparation of slant, butts & plates
3	Methods of Inoculation and Study of Growth Characteristics: a. Liquid Medium b. Solid Media (Slants, Butts and Plates)
4	Isolation of pure cultures and study of colony characteristics.

REFERENCES:

VSC1 SVSC107

1. Madigan, M. T.; Bender K. , Buckley D. (2021). Brock Biology of Microorganisms. 16th Global edn-San Francisco: Pearson International edition.
2. Pelczar Jr, M. J.; Chan, E.C.S. & Krieg, N. R. (1986). Microbiology 5th edn. New York:Tata McGraw-Hill Education Pvt. Ltd
3. Willey J. , Sandman K , Wood D. Prescott's Microbiology (ISE)(2019) 11th edn– McGraw-Hill Education.

NAME OF THE COURSE	VSC 2: CONTROL OF MICROORGANISMS	
CLASS	FYBSc	
COURSE CODE	SVSC108	
NUMBER OF CREDITS	01 (Theory) + 1 (Practical)	
NUMBER OF LECTURES PER WEEK	01 (Theory) + 2 (Practical)	
TOTAL NUMBER OF LECTURES PER SEMESTER	15 (Theory) + 30 (Practical)	
EVALUATION METHOD	CONTINUOUS ASSESSMENT	SUMMATIVE ASSESSMENT
TOTAL MARKS	50	-
PASSING MARKS	20	-

COURSE OBJECTIVES:

CO 1.	To provide understanding of the key concepts related to microbial control
CO 2.	To compare the physical methods of microbial control
CO 3.	To explain the purpose advantages and limitations of using a variety of methods based on use of high temperature
CO 4.	To highlight different types of Radiations and filters used in microbiology laboratory
CO 5.	To give an overview of mode of action, uses, limitations of the common chemical disinfectants and sterilizing gases.
CO 6.	To train the students to choose appropriate method for killing or inhibiting microorganisms
CO 7	To provide hands-on training in disinfection and safe disposal of waste in a laboratory setting.
CO 8	To provide hands-on training in sterilizing glassware and microbiological media using various methods and perform aseptic transfers of media.
CO 9	To demonstrate the use of membrane filters in bacteria proof filtration.
CO 10	To provide training in performing experiments to study the effects of UV light, osmotic pressure, and oligodynamic action of heavy metals on the growth of microorganisms.

COURSE LEARNING OUTCOMES:

CLO 1.	The learner will be able to define and differentiate among the major terms for microbial control, citing examples of each.
CLO 2.	The learner will be able to describe dry heat and moist heat methods and their chief applications for sterilization and disinfection.
CLO 3.	The learner will be able to apply the concept of sterilization by filtration for practical use.
CLO 4.	The learner will be able to differentiate between ionizing and nonionizing radiations used for the purpose of destroying microbial contaminants

CLO 5.	The learner will be able to summarize the modes of action and practical uses of alcohols, phenolics, quaternary ammonium compounds, halogens and heavy metal solutions as disinfectants/ antiseptics.
CLO 6.	The learner will be able to identify preferred physical methods / uses of chemical disinfectants in various scenarios.
CLO 7.	The learner will be able to disinfect surfaces and dispose off laboratory waste safely, demonstrating their understanding of laboratory safety.
CLO 8.	The learner will be able to demonstrate the ability to sterilize glassware and microbiological media using various methods and perform aseptic transfers of media.
CLO 9.	The learner will be able to analyze the antimicrobial activity of a disinfectant by the disc diffusion method, the effects of UV light, osmotic pressure, and oligodynamic action of heavy metals on microorganisms.

SVSC108	Control of Microorganisms (15 lectures)
	1. Concept of sterility,Need for control, Definition of Antimicrobial agents Methods of microbial control: 2. Physical: a. Moist heat, Dry heat b. Radiation c. Filtration d. Low temperature e. Desiccation and Osmotic pressure 3. Chemical : a. Phenolics b. Alcohols c. Heavy metals d. Halogens e. Quaternary ammonium compounds f. Chlorhexidine g. Sterilizing gases- ETO, Formaldehyde
Practical Sr. No.	Control of Microorganisms Practicals (30 lectures)
1	Introduction to Laboratory equipments
2	Disinfection & Safe Disposal of waste
3	Sterilization of glassware and microbiological media
4	Aseptic transfer of media
5	Demonstration of use of membrane filter and efficiency of sterilization
6	Effect of UV light on microorganisms. (Demonstration)
7	Effect of Osmotic pressure on microorganisms

8	Oligodynamic action of heavy metals
9	Testing antimicrobial activity of a disinfectant by disc diffusion method.

REFERENCES:

VSC 2 SVSC108

1. Tortora G.J., Funke, B.R., Case, C.L., 2020 Microbiology: an introduction. 13th Global edn. Pearson
2. Willey J. , Sandman K , Wood D. Prescott's Microbiology (ISE)(2019) 11th edn– McGraw-Hill Education.
3. Talaro, K. P., Chess K. 2012. Foundations in Microbiology 8th International edn, NewYork:McGraw Hill.

ASSESSMENT DETAILS

A. FOR DSC

I. Continuous Assessment (CA): 50 marks

- 2 CA activities of which the Test is 25 marks.
- An additional activity will be held ONLY for those who missed any one or both of the 2 activities, due to valid reasons, or failed.

II. SUMMATIVE ASSESSMENT (SA): 50 marks

- DSCs (Major) students must appear for **at least** one of the two Continuous Assessments (CAs) activities for each Semester, to be eligible for the Summative Assessment (SA).
- All units of the syllabus will be covered in SA and will be given equal weightage.
- Students remaining absent for both CAs will not be allowed for SEE.
- An additional SEE will be held for those who are absent, due to valid reasons, for the main/regular SEE.

Practical Assessment (50 marks)

- DSC - The duration of the practical exam will be two hours.
- To appear in the practical exam, students must bring a properly certified journal.

B. FOR VSC: Only Continuous Assessment.

I. Continuous Assessment (CA): 50 marks

- 2 CA activities will be conducted one each based on theory and practicals respectively.
    1. CA Theory - Test of 20 marks and 5 marks for active participation in Theory Lectures.
    2. CA Practicals - Practical Evaluation of 20 Marks and 5 marks for active participation in Practical Sessions.

SEMESTER 2

NAME OF THE COURSE	MICROBIAL DIVERSITY, INTERACTIONS AND GROWTH	
CLASS	FYBSc	
COURSE CODE	SMCB122MJ	
NUMBER OF CREDITS	3	
NUMBER OF LECTURES PER WEEK	3	
TOTAL NUMBER OF LECTURES PER SEMESTER (theory)	45	
EVALUATION METHOD TOTAL MARKS	CONTINUOUS ASSESSMENT 50	SUMMATIVE ASSESSMENT 50
PASSING MARKS	40 out of 100	

COURSE OBJECTIVES:

CO 1.	To promote the understanding of fundamental aspects of viruses focussing on general structure and reproduction
CO 2.	To give an overview of Rickettsia and Chlamydia.
CO 3.	To provide a glimpse of the world of Actinomycetes and Archaebacteria
CO 4.	To provide understanding of the key concepts related to microbial growth and outline parameters that affect growth.
CO 5.	To train the students to evaluate and choose appropriate methods for estimating microbial growth.
CO 6.	To give realization of the crucial role of microorganisms in the cycling of nutrients.

COURSE LEARNING OUTCOMES:

CLO 1.	The learner will be able to summarize the features of different types of viruses.
CLO 2	The learner will be able to study the growth pattern of bacterial culture in a closed system.
CLO 3	The learner will be able to describe direct -indirect methods of enumerating microorganisms.

CLO 4	The learner will be able to apply these methods for estimating growth in various scenarios .
CLO 5	The learner will be able to explain the concept of pure culture.
CLO 6	The learner will be able to define the major terms of microbial associations.
CLO 7	The learner will be able to outline different types of microbial interactions with examples.
CLO 8	The learner will be able to identify the role of microbial species in the nutrient cycles .
CLO 9	The learner will be able to select appropriate growth conditions/ techniques for experimental work.

UNIT 1	Study of Viruses, Rickettsia, Chlamydia, Actinomycetes and Archaea (15 Lectures)
1.1	a. Viruses: i. Historical highlights, general properties of viruses, Structure of viruses- capsids, envelopes and genomes. ii. Overview of methods for cultivation of viruses. iii. Bacteriophages: Life cycle of Lytic (T4 phage) and Lysogenic (lambda) phage. b. Rickettsia and Chlamydia: General characteristics, diseases and vectors.
1.2	**a.** Actinomycetes: General characteristics, groups and Significance. **b.** Introduction to Archaea- General characteristics , groups and Significance.
UNIT 2	Study of Microbial Interactions (15 lectures)
2.1	Types of Microbial Interactions: **a.** Mutualism: Lichens, Rhizobia, Mycorrhizae and Frankia. **b.** Amensalism: Antibiosis **c.** Predation and Parasitism **d.** Commensalism: Normal flora of the human body i. Skin, ii. Respiratory tract, iii. Gastrointestinal tract and iv. Genitourinary tract.
2.2	Role of microorganisms in cycling of nutrients: Carbon, Nitrogen, Sulphur, Phosphorus and Iron.
UNIT 3	Microbial Growth (15 lectures)
3.1	Definition of growth, Mathematical Expression and Growth curve Influence of environmental factors on growth
3.2	-Measurement of growth **a.** Direct microscopic count and Haemocytometer. **b.** Viable count – Spread plate and Pour plate technique

	c. Measurements of cell constituents. **d.** Turbidity measurements – Nephelometer and spectrophotometer

REFERENCES:

SMCB122MJ

1. Tortora G.J., Funke, B.R., Case, C.L., 2020 Microbiology: an introduction. 13th Global edn. Pearson
2. Willey J. , Sandman K , Wood D. Prescott's Microbiology (ISE)(2019) 11th edn– McGraw-Hill Education.
3. Madigan, M. T.; Bender K. , Buckley D. (2021). Brock Biology of Microorganisms. 16th Global edn-San Francisco: Pearson International edition.
4. Pelczar Jr, M. J.; Chan, E.C.S. & Krieg, N. R. (1986). Microbiology 5th edn. New York:Tata McGraw-Hill Education Pvt. Ltd
5. Talaro, K. P., Chess K. 2012. Foundations in Microbiology 8th International edn, NewYork:McGraw Hill.
6. Stanier, R. Y.; Ingraham, J. L.; Wheelis, M. L. & Painter, R. P. (1992). General Microbiology 5th edn. Cornell university: Macmillan, Hampshire & London.

NAME OF THE COURSE	MICROBIAL DIVERSITY, INTERACTIONS AND GROWTH PRACTICAL	
CLASS	FYBSc	
COURSE CODE	SMCBP122MJ	
NUMBER OF CREDITS	1	
NUMBER OF LECTURES PER WEEK	2	
TOTAL NUMBER OF LECTURES PER SEMESTER	30 hours	
EVALUATION METHOD TOTAL MARKS PASSING MARKS	CONTINUOUS ASSESSMENT - -	SUMMATIVE ASSESSMENT 50 20

COURSE OBJECTIVES:

CO 1	To train learners to perform the spot assay for detection of bacteriophages.
CO 2	To train learners to acquire skills in observing morphological changes of Actinomycetes with time by performing slide culture technique.
CO 3	To develop the ability to prepare and examine wet mounts of lichens and learn to identify the fungal and algal symbionts.
CO 4	To impart practical skills in isolation, staining, and characterization of Nitrogen fixing bacteria Rhizobium and Azotobacter.
CO 5	To train learners to enumerate microorganisms using a variety of physical and cultural methods.
CO 6	To equip learners with the skills to analyze the growth of microorganisms with respect to time enabling them to understand the dynamics of microbial growth under standard laboratory conditions.
CO 7	To train learners to study the effects of pH and temperature on microbial growth in the laboratory.

COURSE LEARNING OUTCOMES:

CLO 1.	The learner will be able to perform spot assay for detection of bacteriophages.

CLO 2	The learner will be able to demonstrate the ability to prepare and examine slide cultures of Actinomycetes, identifying the changes in morphology characteristics with respect to time.
CLO 3	The learner will be able to prepare and examine wet mounts of lichens and identify the fungal and algal components.
CLO 4	The learner will be able to isolate and study the characteristics of Rhizobium and Azotobacter from root nodules and soil respectively and understand their role in Nitrogen fixation.
CLO 5	The learner will be able to enumerate bacteria by Breed's Count, using Haemocytometer, Brown's opacity tubes, and viable count method.
CLO 6	The learner will be able to plot the bacterial growth curve and identify the phases of the bacterial growth curve after culturing microorganisms under standard conditions.
CLO 7	The learner will be able to suggest the optimum growth pH and temperature of microorganisms based on experimental findings under laboratory conditions.

Practical Sr. No.	**DSC practicals - Microbial Diversity, Interactions and Growth**
1	Spot assay of Bacteriophage
2	Slide Culture technique (Actinomycetes)
3	Wet Mount of Lichen
4	Rhizobium: Staining & Isolation.
5	Azotobacter: Enrichment, Isolation & staining.
6	Normal flora: Isolation of microorganisms from skin and saliva
7	Enumeration of bacteria by Breed’s Count.
8	Haemocytometer.
9	Brown’s opacity tubes.
10	Measurement of cell dimensions-Micrometry
11	Viable count: Spread plate method
12	Viable count : Pour plate method
13	Study of Growth curve (Demonstration)
14	Study of effect of pH and temperature on growth

NAME OF THE COURSE	MICROBES & HUMAN HEALTH	
CLASS	FYBSc	
COURSE CODE	SSEC207	
NUMBER OF CREDITS	1 +1	
NUMBER OF LECTURES PER WEEK	1 theory + 2 practical	
TOTAL NUMBER OF LECTURES PER SEMESTER	15+30	
EVALUATION METHOD TOTAL MARKS PASSING MARKS	CONTINUOUS ASSESSMENT 50 20	SUMMATIVE ASSESSMENT -

COURSE OBJECTIVES:

CO 1.	To provide an overview of defence mechanisms in the human body.
CO 2.	To outline the progress of infection to disease.
CO 3.	To explain the interactions of the human immune system with a pathogenic microorganism.
CO 4.	To train students to use various techniques of detecting microbial virulence factors

COURSE LEARNING OUTCOMES:

CLO 1.	The learner will be able to list differences between various types of infections.
CLO 2.	The learner will be able to specify the purpose of different types of virulence factors in pathogenic bacteria.
CLO 3.	The learner will be able to study the defence mechanisms as well as factors which affect the infection process in human body
CLO 4.	The learner will be able to identify the types of immune responses

SSEC207	Microbes & Human Health (15 Lectures)
	Important terminologies **a.** Infection and disease: Primary and secondary infections, Contagious infections, Opportunistic pathogens, Zoonoses and Vector borne infections. **b.** Factors affecting infection: Hosts: Natural, Species and Racial resistance. Individual resistance.

	c. Microbial virulence factors in adherence, invasion, colonization and disease. **d.** Host defense against infection: An Overview i. First line of defense: Skin, respiratory tract,gastrointestinal tract, genitourinary tract and eyes. ii. Second line of defense: Fever, Inflammation and Phagocytosis iii. Third line of defense: Brief introduction to Immunity (active passive, natural and acquired)
Practical Sr. No.	Microbes & Human Health Practicals (30 Lectures)
1	Study of virulence factors:
	a) hemolysin,
	b) coagulase,
	c) lecithinase
	d) capsule demonstration
2	Study of role of fomites in spread of diseases
3	Assignment: Types of WBCs and their significance

REFERENCES:

SSEC207

1. Pelczar Jr, M. J.; Chan, E.C.S. & Krieg, N. R. (1986). Microbiology 5th edn. New York:Tata McGraw-Hill Education Pvt. Ltd
2. Tortora G.J., Funke, B.R., Case, C.L., 2020 Microbiology: an introduction. 13th Global edn. Pearson
3. Willey J. , Sandman K , Wood D. Prescott's Microbiology (ISE)(2019) 11th edn– McGraw-Hill Education.
4. Talaro, K. P., Chess K. 2012. Foundations in Microbiology 8th International edn, NewYork:McGraw Hill.

NAME OF THE COURSE	MICROBIAL TECHNOLOGY (THEORY + PRACTICAL)	
CLASS	FYBSC	
COURSE CODE	SSEC208	
NUMBER OF CREDITS	1+1	
NUMBER OF LECTURES PER WEEK	1+2	
TOTAL NUMBER OF LECTURES PER SEMESTER	15+30	
EVALUATION METHOD TOTAL MARKS (**Theory + Practical**) PASSING MARKS	CONTINUOUS ASSESSMENT 50 20	SUMMATIVE ASSESSMENT -

COURSE OBJECTIVES:

CO 1	To review the commercial application of microorganisms in food production and medicine
CO 2	To train students to apply the knowledge of microbiology in agriculture and environment sustainability for the benefits of Society.
CO 3	To acquaint the learner with basic terms and methods related to genetic engineering.
CO 4	To train learners to analyze the organisms presented in fermented foods by using Gram staining.
CO 5	To train learners to use microbiological techniques such as crowded plate technique, and isolation of amylase producers to isolate and identify potential industrially important microorganisms.
CO 6	To train learners to prepare biofertilizers and assess their efficiency in enhancing plant growth.
CO 7	To impart knowledge of the commercial applications of microbial enzymes through a survey on enzymes used in consumer products.

COURSE LEARNING OUTCOMES:

CLO 1	The learner will be able to outline applications of microorganisms in production of food , additives and dairy industry.
CLO 2	The learner will be able to describe chief applications of microbes as biofertilizer,

	biopesticides and animal feed.
CLO 3	The learner will be able to cite examples of GMOs as tools for pharmaceutical products and bioremediation.
CLO 4	The learner will be able to apply microbial staining or culturing techniques to isolate and identify microorganisms involved in fermentation processes, production of antibiotics and enzymes.
CLO 5	The learner will be able to prepare and evaluate Azotobacter based biofertilizers and evaluate its efficiency in enhancing plant growth through potted plant experiments.
CLO 6	The learner will be able to conduct a survey and prepare a report on the use of microbial enzymes in commercial consumer products.

SSEC208	Microbial Technology (15 Lectures)
	Microbial technology and the four 'F'(Food, Feed, Fuel and Functional molecules) a. Applications of microorganisms in Food industry - Fermented food products, Alcoholic beverages, Dairy Products, Probiotics, b. Commercial Production of Microorganisms- Feed / SCP production, Biofertilizers, Biopesticides c. Overview of products from Microorganisms: antibiotics, enzymes,vitamins, polysaccharides, Fuel d. Genetically engineered microorganisms and their applications in Human health (Insulin), Agriculture (BT cotton), Environment (Bioremediation of Oil spill)
Practical Sr. No.	Microbial Technology Practicals (30 Lectures)
1	Wine production from grapes / Bread making
2	Study of microorganisms in fermented food by Gram Stain (curd or idli batter)
3	Isolation of amylase producer
4	Detection of antibiotic producers (Crowded plate technique)
5	Preparation of biofertilizer and studying its efficiency
6	Assignment: Microbial enzymes in commercial consumer products (Survey and report)

REFERENCES:

SSEC208

1. Willey J. , Sandman K , Wood D. Prescott's Microbiology (ISE)(2019) 11th edn– McGraw-Hill Education
2. Madigan, M. T.; Bender K. , Buckley D. (2021). Brock Biology of Microorganisms. 16th Global edn-San Francisco: Pearson International edition.

3. Pelczar Jr, M. J.; Chan, E.C.S. & Krieg, N. R. (1986). Microbiology 5th edn. New York:Tata McGraw-Hill Education Pvt. Ltd
4. Tortora G.J., Funke, B.R., Case, C.L., 2020 Microbiology: an introduction. 13th Global edn. Pearson

ASSESSMENT DETAILS

A. FOR DSC

III. Continuous Assessment (CA): 50 marks

- 2 CA activities of which the Test is 25 marks.
- An additional activity will be held ONLY for those who missed any one or both of the 2 activities, due to valid reasons, or failed.

IV. Summative Assessment (SA): 50 marks

- DSCs (Major) students must appear for **at least** one of the two Continuous Assessments (CAs) activities for each Semester, to be eligible for the Summative Assessment (SA).
- All units of the syllabus will be covered in SA and will be given equal weightage.
- Students remaining absent for both CAs will not be allowed for SEE.
- An additional SEE will be held for those who are absent, due to valid reasons, for the main/regular SEE.

Practical Assessment (50 marks)

- DSC - The duration of the practical exam will be two hours.
- To appear in the practical exam, students must bring a properly certified journal.

B. FOR SSEC: Only Continuous Assessment.

II. Continuous Assessment (CA): 50 marks

- 2 CA activities will be conducted one each based on theory and practicals respectively.
    3. CA Theory - Test of 20 marks and 5 marks for attendance in theory lectures.
    4. CA Practicals - Practical Assessment of 20 Marks and 5 marks for attendance in Practical sessions.